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two terminal joints of the left forefinger in a thick rubber sheath to exclude sensations of pressure, and with the hand well supported, rested the finger in a comfortable position by a system of pulleys and compensating weights. He now determined how slight a movement at the joint brought about by a pull upon the finger (interphalangeal) could be detected. He found for the interphalangeal joint .072, .061 and .056 cm.; for the metacarpo-phalangeal .076, .070 and .057 cm. He found, too, that the rate of motion was an important factor, the above motions being detected only if they were performed within .06 second in the former case or .08 second in the latter. A motion about half the extent of those above recorded was detected if executed within $\frac{1}{10}$ second. It must be noted that the subject is entirely passive, and that the sensations other than those arising from the motion at the joint are practically eliminated.

J. J.

Psychologie mathématique et psychophysique. P. TANNERY. Revue philosophique, Février, 1888.

Under the above heading, M. Tannery, one of the most active critics of the mathematical side of psychophysics, reviews a series of recently issued pamphlets, some of which treat of the philosophic foundations of the concepts that underlie mathematical operations, and the others of the mathematical basis of a psychophysic system. The review of the former is significant as indicating the general appreciation of the intimate relation that exists between the application of philosophical truths to the sciences, and the abstract discussion of these truths to which both the logician and the mathematician contribute. Under the latter point of view, Dr. Elsas's critique of psychophysics, and the review of psychophysical formulae by Köhler in Wundt's *Studien*, form the basis of criticism. Dr. Elsas discusses two fundamental questions: the first, whether Fechner's mathematical formulae are deducible from the observed facts; the second, whether a psychophysic system in Fechner's sense is possible. To both these questions he gives a negative answer. Under the first head he argues that the facts of Weber's law can be expressed by several mathematical formulae, each as good as the other, and yet contradictory among themselves; under the second he considers quantity applicable only to the physiological representative of the sensation, and not to a relation between the physical and the psychical. M. Tannery declares himself in accord with both these positions, though he has other ways of stating them, and is perhaps more ready to expect future experimentation to decide as to the most adequate mathematical statement of psychophysical facts. Köhler's article is a very useful one, because it allows of a survey of the many formulae that have been proposed instead of Fechner's, and inevitably suggests the conviction, as Tannery points out, that the entire topic is obscure by reason of the confusion of distinct questions with one another. Köhler himself accepts the "just observable difference" as a real entity and a unit of measure; and this premise prevents him from recognizing the merit of the work of Delboeuf, a very important contribution to the subject. He lays stress upon the distinction of Wundt between the sensation and the apperception of the same, and perhaps it will be by a firm adherence to this and other distinctions that the mist will be raised from this important part of experimental psychology. A hopeful indication in this direction is furnished by

the fact that almost all of the recent writers upon the topic have freed themselves from the uncritical conceptions that Fechner introduced, and agree in the main upon a general end which the establishment of a psychophysics has in view. J. J.

Die Deutung der psychophysischen Gesetze. AD. ELSAS. Philosophische Monatshefte, XXIV, 3 und 4, 1887.

This article forms part of a controversy regarding the fundamental validity and import of the psychophysic law, which has been raging since the appearance of Fechner's first work in this field, and had busied the founder of psychophysics up to the day of his death. It will hardly be feasible to recount here the many and detailed issues which the author takes with Fechner's theories, but a brief notice of their general features is in place, especially as the attack is directed against the most fundamental parts of Fechner's work, and in fact, if accepted, as it promises to be, will be so entirely subversive of much of Fechner's mathematical deductions that Dr. Elsas acknowledges his trepidation in taking so bold a position. Fechner uses mathematical principles, says the author, not as tools, but as a magic wand by which what is not contained in the facts can be brought out of them, neglecting to remember that mathematical aids can only simplify and arrange what is implicit in the facts as ordinarily stated. Fechner passes from Weber's law, which simply states the dependence of the perceptibility of a difference between sensations upon the ratio of the stimuli that gave rise to them, to the logarithmic form of the law by aid of a comprehensive mathematical theorem ("Hilfs-princip"). Dr. Elsas shows conclusively that this principle is unnecessary, and that its agreement with fact in the application of it made by Fechner must be regarded as accidental. Again, Fechner's deductions start with the assumption that sensations can be summated; this the author refuses to accept, and points to the sensations of tone intervals, in which the summation does not give the effect of the resulting interval, but it requires the product to do so. Once more, the "relational hypothesis," as Fechner terms his exposition of the law, is only one of a number of possible hypotheses that fit the facts quite as well as does Fechner's, and the decisive ground of choice between them depends on considerations of naturalness which Fechner hardly touches upon. Fechner sees in the fact that his formulae take into account the existence of the threshold a valuable proof of their validity; Dr. Elsas shows that other formulae have the same merit, and that the threshold is made mechanically necessary by the physiological adaptations of the organism. In fine, the author holds that Fechner's mathematical deductions are irrelevant, that they lead to a false view of the entire field of psychophysics, and that they neglect to consider the natural, physiological import of the facts which it is the aim of that science to coordinate and systematize.

J. J.

Die Willenshandlung: ein Beitrag zur physiologischen Psychologie. HUGO MÜNSTERBERG. Freiburg, I. B., 1888, 163 pp.

In his preface the author tells us that his first plan in writing a work on the Will was to prepare a general treatise, setting forth in the first part the physiology and pathology of the neuro-muscular system, whose function it is to conduct voluntary movements; in the second, to present the psychology of the will and make connec-